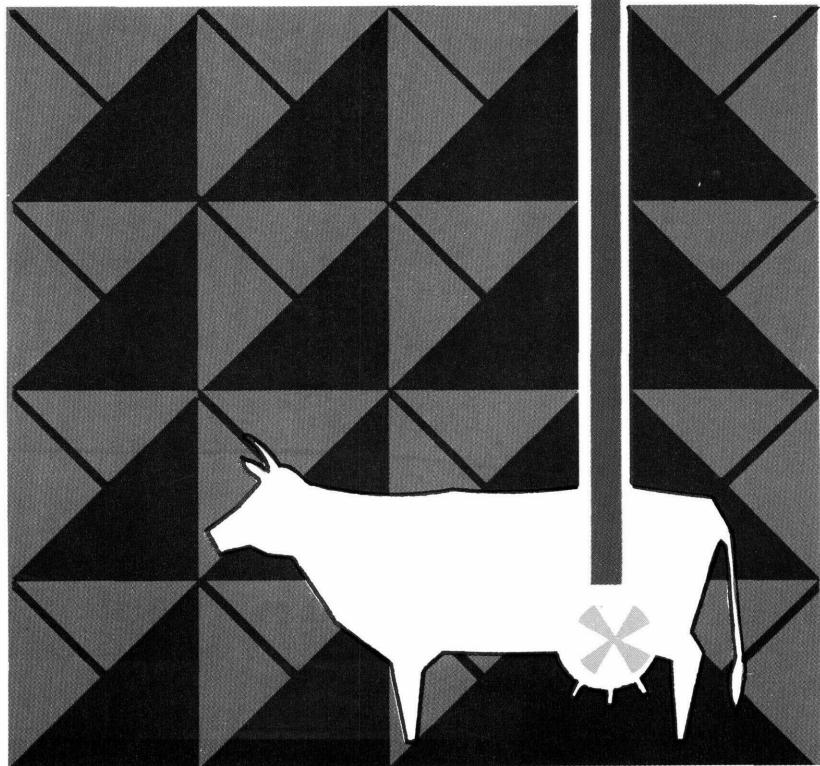


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WHAT YOU  
CAN DO  
ABOUT **Bovine  
Mastitis**



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CMT reaction photos and grading chart in this bulletin supplied through the courtesy of the University of California Agricultural Extension Service.

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**WHAT YOU  
CAN DO  
ABOUT**

# **Bovine Mastitis**

Bovine mastitis, an inflammation of the udder, is the most costly disease to dairymen. Most of the economic loss from this disease results when—

- Cows produce less milk because of permanent udder damage.
- Cows are culled because they do not respond to therapy, or do not produce enough milk because of extensive udder damage.
- Milk must be discarded from cows showing signs of inflammation and from those undergoing antibiotic treatment.
- Treatment with antibiotics or other drugs is expensive.

In addition, an increasing amount of milk from mildly mastitic cows must be discarded. Market milk is examined regularly to assure more uniform compliance with regulations prohibiting the sale of milk from diseased cows. When milk is found to contain an excessive number of leucocytes, the producer is warned to take corrective action. If the excessive cell count con-

tinues, the producer will be shut off the market.

It is estimated that all of these losses cost the average 50-cow dairyman over \$2,000 per year. Mastitis, then, costs American dairymen over ½ billion dollars annually.

## **A COMPLETELY HEALTHY HERD**

It is doubtful that any herd can be completely free of mastitis. Mastitis is a very complex disease and to date there are no sure cures and no preventive measures which are totally effective. Even so, many dairymen are not using currently recommended practices to reduce the incidence and severity of this disease.

If you are not familiar with this often evasive and subtle disease and have not taken adequate preventive measures, now is the time to start an all-out campaign to identify problem cows and take corrective action.

## **RECOGNIZING MASTITIS**

A cow's udder becomes inflamed primarily as a result of bacterial infection. This inflammation can be acute or chronic.

Acute mastitis is easy to recognize

and it is dangerous. It is the most severe form of this disease and can cause death to the cow.

The affected quarter is hot, very hard, and tender. The hardness of the

udder is caused by an influx of white blood cells and fluids from the blood to fight the bacterial infection.

If the action of the bacteria goes unchecked, some of the normally functioning tissue will be destroyed. It will then be replaced by scar tissue which can be felt as hard lumps or knots.

Eventually, the entire gland atrophies—shrivels up and becomes inactive. Milk production may stop completely. Should any "milk" continue to flow, it will be lumpy or stringy. Or, it may be strawcolored, tinged with blood, and have yellow clots.

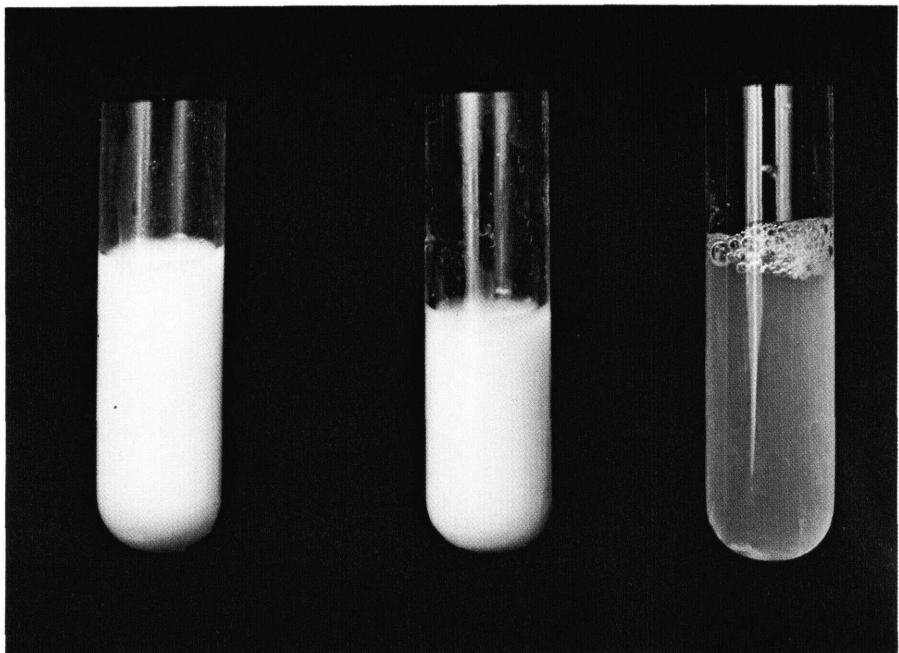
In acute mastitis, the entire body of the cow reacts to the infection. The effects are depression, rough coat, dull eyes, loss of appetite, constipation, fever, and eventually—death.

Your infected cow can have several or all of these symptoms, depending on the severity of the disease.

Chronic mastitis is commonly a problem in most dairy herds. Although not as severe as acute mastitis, the chronic form is more serious economically. It accounts for most of the economic loss due to mastitis. The reasons for this are that many chronic cases either do not respond to treatment, or go unrecognized or untreated.

If your cow has a recognizable chronic form, you may notice the following: flakes, clots, a watery or unusual appearance of the milk; occasional slight swellings and hardness of the udder; a rapid, unexpected decrease in milk production.

Very often, however, only a few



**Increasing severity of mastitis results in progressive deterioration of milk quality.**

or perhaps none of these symptoms will be evident. Occasionally, an eventual hardness of the udder is the only noticeable sign.

If chronic mastitis goes unchecked over a period of time, damage to the udder can be as serious as with the acute form. An advanced, chronic case can completely destroy all milk-producing tissue.

### Bacterial Infection

There are over 20 different organisms that cause mastitis, and all of these can be transmitted from cow to cow. Two types of bacteria most frequently found in any herd are *Streptococcus agalactiae* and *Staphylococcus aureus*. There are differences among bacteria in their response to treatment. In severe cases or when the incidence of new infection is high, it is important to identify the organisms responsible.

*Strep agalactiae* is a very specialized type of bacteria. It lives only in the cow's udder. These bacteria can be spread to healthy cows by humans and unsanitized milking equipment.

It is possible to eradicate *Strep agalactiae* with proper antibiotic treatments.

*Staph aureus*, on the other hand, lives outside as well as inside the udder. It can be harbored in a variety of places in the cow's environment, such as bedding, feed troughs, and milking equipment. Simple contact of the teats with contaminated surfaces may lead to eventual penetration of *staph aureus* into the udder. Once this infection is well established, it cannot always be cured. Certain strains of this bacteria can cause severe cases of mastitis.

### Physical Injury

Physical injury can also cause inflammation of the udder and a rise in the number of leucocytes in the milk.

One of the greatest dangers of teat injury is that bacterial invasion often follows. Injury often hampers adequate closing of the teat canal between milkings. These wide or dilated teat canals make the interior of the udder easily accessible to bacteria.

## EXAMINE EACH COW

Adequate prevention and control of mastitis depends on your knowing which cows have the disease.

### Diagnosis

#### *Strip Cup Testing*

Before each milking, examine the milk of each cow with the aid of a strip cup. The strip cup is a useful device for showing the presence of mastitis. Not only is it simple to use,

it also can easily be worked into your regular milking procedure. Use it when you are stimulating your cow for milk letdown.

Direct the first few streams of milk (foremilk) onto the strip cup. Any clots, flakes, threads, stringy matter, watery secretions, or abnormal color is an indication of mastitis.

The presence of blood, however, especially in the foremilk, does not necessarily mean that the cow has



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**Most cases of mastitis can be detected with regular use of the strip cup.**

mastitis. This can indicate that a blood vessel has been broken from physical injury or from extensive swelling at calving time.

When using the strip cup, test each quarter separately. Mastitis-causing organisms usually invade only one quarter without infecting the others.

#### **Physical Examination**

While using the strip cup, you have an excellent opportunity to examine the physical appearance of the udder and teats. Look for scaling, chapping, cracking, swelling, and redness.

Just after milking, examine the udder more carefully. While removing the teat cups, manipulate each quarter with your hand. After milking, the udder should be soft and pliable.

If you detect hard lumps, your cow either once had mastitis or now has it.

These lumps are scar tissues resulting from the disease.

#### **CMT Testing**

Further aids in diagnosing mastitis are the cow-side screening tests for the detection of increased leucocyte concentration in the milk. Of these, the California Mastitis Test (CMT) is the easiest and the most practical to use at the cow's side.

When a cow has mastitis, the CMT will indicate the resulting increase of leucocytes in the milk. Varying degrees of thickening or gelling of the mixture will occur, depending on the severity of the disease.

(See examples of CMT reactions on pages 6 and 7.)

In order to conduct the CMT, you need a specially designed plastic paddle

with four shallow cups, and a supply of the test solution.

To test your cow, stimulate her to complete milk letdown, discard the first few streams of milk from each quarter, then direct several streams of milk from each quarter into a separate compartment on the paddle. Avoid using the first streams of stripping because these have a higher concentration of cells and will result in a stronger-than-normal CMT reaction.

The proper amount of milk to use is the amount that will remain in the cups when you hold the paddle almost straight up and down.

Now, add the same amount of CMT solution; too much or too little will give false results.

Gently rotate the paddle to thoroughly mix the milk and solution. This takes about 10 seconds. Keep rotating the paddle while milk and reagent are combining to produce a reaction. When you have observed the completed reaction, consult the grading chart on page 8 and record the results from each quarter. Rinse

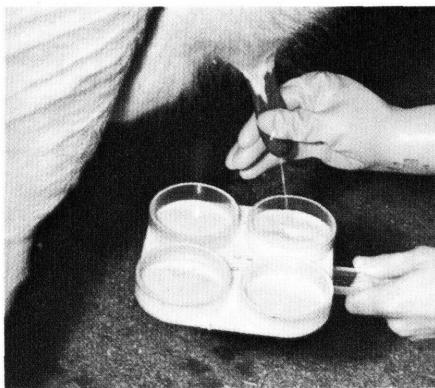
the paddle in clean water, shake off excess moisture before moving to the next cow.

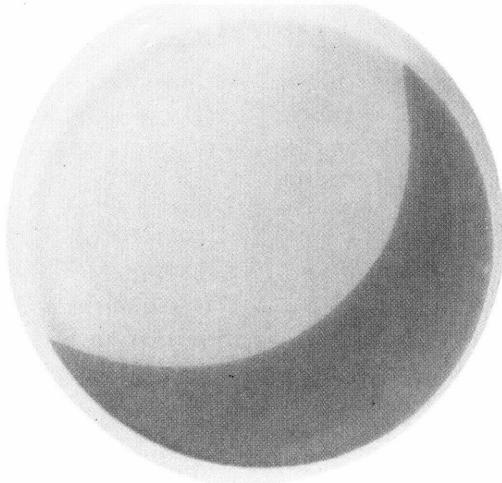
If you have not already done so, organize a monthly routine of CMT testing your herd. By charting the results monthly, you can tell at a glance any trend toward mastitis in your herd.

If your herd is large, you may not have time to take individual quarter samples from every cow, every month. In many areas of the country, the CMT can be conducted monthly as part of the routine DHI test.

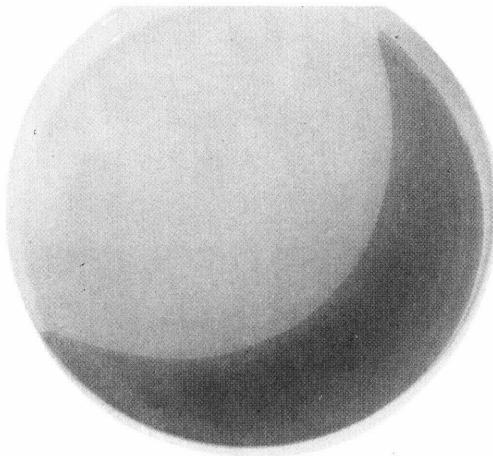
Bucket milk testing is an excellent way to screen individual cows in your herd. In bucket samples, however, mastitic milk from one quarter can be diluted with normal milk from another quarter. Because of this possibility, even a CMT reading of 1 may reflect a serious infection in one quarter or a mild irritation in several quarters.

If the results of your CMT tests indicate a mastitis problem, consult your veterinarian.

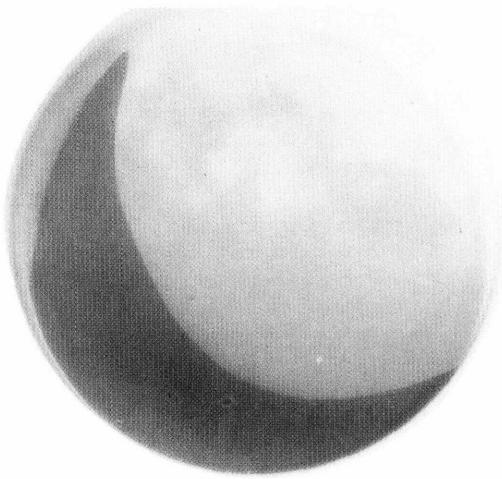




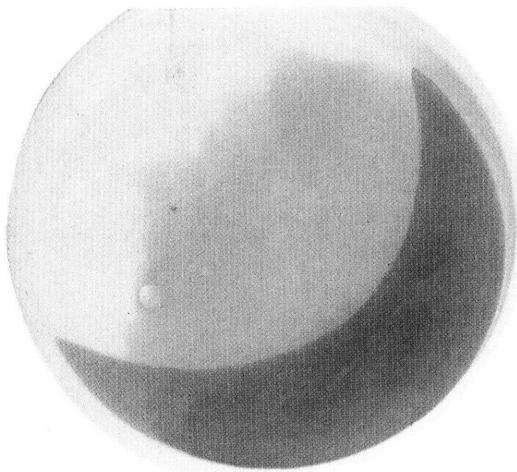
**CMT negative. Mixture remains liquid with no evidence of formation of a precipitate.**



**CMT 1. A distinct precipitate with some thickening. Note the absence of large clumps characteristic of the more positive reactions.**



**CMT 2.** This mixture thickens immediately with larger clump (gel) formation.  
Note the tendency for clear spots to appear within the mixture.



**CMT 3.** A heavy gel forms and the mixture becomes convex (rounded). When the plate is tipped, the gel pulls away from the sides and bottom of the plate, leaving large clear areas.

## GRADING AND INTERPRETATION

<b>Symbol</b>	<b>Suggested meaning</b>	<b>Description of Visible Reaction</b>	<b>Interpretation*</b>
—	negative	Mixture remains liquid with no evidence of formation of a precipitate.	0-200,000 cells/ml
T	trace	A slight precipitate forms and is seen to best advantage by tipping the paddle back and forth and observing the mixture as it flows over the bottom of the cup. Trace reactions tend to disappear with continued movement of the fluid.	150,000-500,000 cells/ml 30-40 per cent PMN
1	weak positive	A distinct precipitate but no tendency toward gel formation. With some milks the reaction is reversible; with continued movement of the paddle the precipitate may disappear.	400,000-1,500,000 cells/ml 40-60 per cent PMN
2	distinct positive	The mixture thickens immediately with some suggestions of gel formation. As the mixture is swirled, it tends to move in toward the center, leaving the bottom of the outer edge of the cup exposed. When the motion is stopped, the mixture levels out and covers the bottom of the cup.	800,000-5,000,000 cells/ml 60-70 per cent PMN
3	strong positive	A gel is formed which causes the surface of the mixture to become convex. Usually there is a central peak which remains projecting above the main mass after the motion of the paddle has been stopped. Viscosity is greatly increased so that there is a tendency for the mass to adhere to the bottom of the cup.	Cell number generally over 5,000,000/ml 70-80 per cent PMN
+	alkaline milk	This symbol should be added to the CMT score whenever the reaction is distinctly alkaline, as indicated by a contrasting deeper purple color.	An alkaline reaction reflects depression of secretory activity. This may occur either as a result of inflammation or in drying off of the gland.
y	acid milk	Bromcresol purple is distinctly yellow at pH 5.2. This symbol should be added to the score when the mixture is yellow.	Distinctly acid milk in the udder is rare. When encountered, it indicates fermentation of lactose by bacterial action within the gland.

\* PMN = Polymorphonuclear leukocyte.

In general a score of 1 should be considered as indicative of 500,000 or more cells, and a score of 2 as evidence of 1,000,000 or more cells.

## **Control**

**ALWAYS CONSULT YOUR VETERINARIAN FOR ADVICE BEFORE ADMINISTERING ANTIBIOTICS.**

Why? Because antibiotics should be used only when absolutely needed and in the proper dosage. This kind of judgment will require the specialized knowledge of your veterinarian.

If antibiotics are misused, bacteria can build up a resistance to them. If this happens, antibiotics will no longer be effective when they are really needed. There is also the possibility that the micro-organisms causing mastitis may not be susceptible to the antibiotics used.

When you consult your veterinarian, he may collect milk samples from suspect cows for laboratory examination. These laboratory tests will show which cows have a bacterial infection. He will find out the type of bacteria present and then prescribe the appropriate antibiotic and treatment. He will also tell you if immediate treat-

ment is necessary. An increasing trend among veterinarians is to recommend that treatment be held off until the dry period, unless the disease is severe.

## **Prevention**

One way to reduce the spread of mastitis is to isolate mastitic cows from the rest of the herd, as much as possible.

When milking your herd, use the "end of string" milking procedure, if possible. Milk young and healthy cows first, older cows next, and mastitic cows last. This will help to minimize the spread of mastitis organisms by the milking equipment. Also, in a stanchion barn, group mastitic cows together to make checking them easier.

If you move a mastitic cow from her stall, make sure that this stall is thoroughly cleaned and new bedding provided before moving another cow into it. Some mastitis organisms can survive in contaminated bedding for a long time.

## **EXAMINE YOUR DAIRY AREA**

Every so often, take a critical look at the efficiency and safety of your dairy setup. Try to see it as an outsider would for the first time. Look carefully for:

- Potential dangers that could cause physical injury to your herd.
- Unsanitary areas that may harbor disease organisms.

Udder injury can be caused by obstacles, clutter, and even inappropriate construction of the dairy barn.

In the grazing and loafing areas, remove sharp or hard objects that cows could trip over or brush up

against; for example, large stones, logs, barbed wire, and equipment. In the barn and barnyard, get rid of dangers like high steps, broken floorboards, and mud holes.

Eliminate or clean unsanitary areas that could cause udder infection. Make sure your barnyard and corrals are well drained. Drainage can be improved by building up the ground with dirt and gravel topped with a porous material, such as wood shavings. Do this also on pathways leading to and from the barn if they are filled with mud and manure. Always maintain stalls that are clean and dry.

## EXAMINE YOUR MILKING MACHINE

Milking machines must be maintained in good working order. Improperly functioning machines will reduce the milk yield, increase the labor required for milking, and increase the incidence of mastitis through teat injury or spread of disease.

Many of the most common causes of milking machine failure can be detected and avoided before causing serious loss if you follow a few simple guidelines:

### Before you buy—

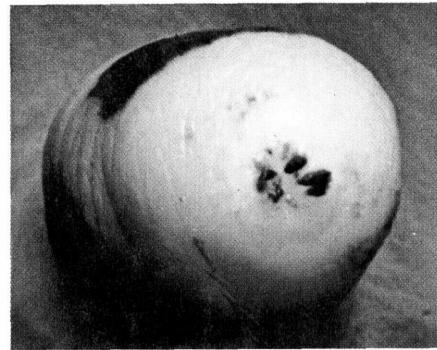
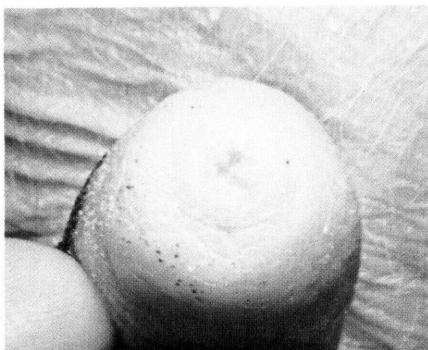
- Select a dealer and a company with a reputation for good service. Good service in the future may be more important than a small saving on the cost of the original equipment. Have all plans and proposals evaluated by your dairy extension agent or fieldman, and appropriate health department officials.

- Follow the manufacturer's recom-

mendation for equipment size and operating specification.

### After you buy—

- Maintain your installation with regular preventive maintenance checks:
  - (a) Replace rubber parts as recommended.
  - (b) Clean and flush vacuum lines regularly.
  - (c) Check vacuum pumps and service them as required.
  - (d) Check and clean vacuum controller regularly.
  - (e) Observe the line vacuum level regularly.
- As your milking system ages and your farm operation changes, be alert to the need for replacements and changes in your milking machine equipment.
- If you suspect trouble, have a competent advisor (machine dealer, fieldman, extension agent, or veterinarian) check your system with you.



**Normal teat compared to one that has been damaged by a malfunctioning milking machine.**

## **EXAMINE YOUR MILKING PRACTICES**

Bad milking practices can be as much a cause of mastitis as a poorly functioning milking machine.

During the milking procedure, there are two critical periods: the beginning and the end. This is when udder irritation is most likely to occur.

At the beginning, if the cow is not sufficiently stimulated before milking, she may have only partial milk let-down or may "hold up" her milk completely. At the end, a cow may be milked out long before the milking machine is finally removed.

If a cow is milked when she is "dry", the sensitive delicate tissues of the udder may be irritated or damaged.

### **Prepare Your Cow For Milking**

#### ***Prewashing***

Prewash cows when udders are caked with mud, dirt, or manure. Use a hose with moderate pressure, a sprinkler system, or any other special washing equipment. Use clean and lukewarm water. Allow prewashed cows to "drip dry".

This interval allows the cow to dry and prevents contaminated water from draining over the teats and into the milk.

#### ***Sanitizing Wash***

To sanitize the udder and teats, wash them with a disinfectant. Use a fresh paper towel for each cow.

Dip the towel into a bucket of sanitizing solution, then gently rub off all adhered dirt and grime from the udder, especially near the teat ends. Dry off washed surfaces.

This step in the milking procedure does not necessarily prevent the spread of infection, but it does help to keep the milk free of manure and dirt.

With the sanitizing wash, you are stimulating your cow to let down her milk. From this point until the time you attach the milking unit, timing and procedure are very important.

With adequate stimulation during the sanitizing wash and follow-through stimulation during strip cup testing, the cow usually will be at the peak of milk letdown in 2 minutes, though the exact moment may vary from cow to cow.

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On the day that you CMT test your herd, you should collect milk samples after you use the strip cup, but before you attach the milking unit.

Never collect samples after milking because you will get a large number of positive CMT quarters. The reason is that after stripping, the number of leucocytes in the milk is normally much higher than in the foremilk. Testing, at this time, will likely show that the cow has mastitis even if she is healthy.

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## **Strip Cup Testing**

As soon as the cleaned surfaces are dry, use the strip cup.

Ideally, any cows that show abnormal milk on the strip cup should be milked after all the other cows are through. If this is not practical, you may either wash and sanitize the contaminated milking unit, or use a separate unit.

Some dairymen have specialized cleaning equipment or other washing systems for this purpose. Others keep an extra milking unit for use on mastitic cows only.

If you find that one of your cows has mastitis, make sure that her milk never goes into the tank.

## **Milking Unit**

When the udder becomes filled and firm, attach the teat cups. Put them on gently, and carefully adjust the hose on the claw for proper milking.

### **Stop When Your Cow Is Milked Out**

Overmilking increases labor costs, slows the milking operation, and may cause udder irritation. When the cow is milked out, the teat cups may crawl upwards and damage the thin-skinned wall of the udder.

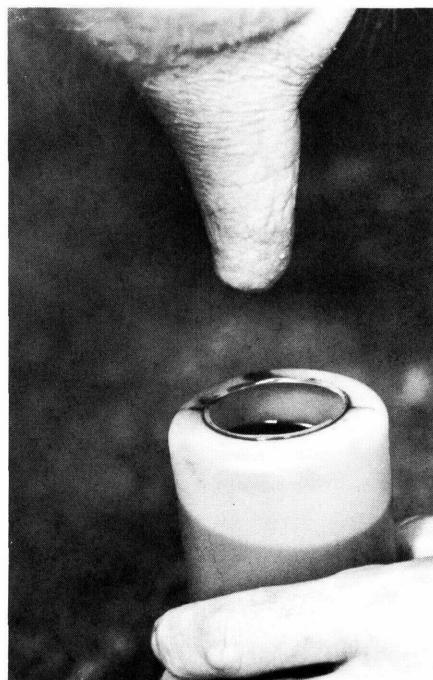
To be safe as well as efficient, remove the milking unit as soon as the cow is milked out. If your herd is small enough, try to remove the teat cups from separate quarters as they are finished.

Good milking management prevents overmilking. Never operate more milking units than you can efficiently

## **A HELPFUL HINT**

Placing the buckets you need on a cart can make your washing procedures easier. You may want to include one bucket with sanitizing solution for washing teats, one filled with water for dipping teat cups, and a cup of special solution for dipping teats. Another bucket can be handy for used towels.

and calmly handle. Be ready to remove the milking unit as soon as the milk flow stops. Normally, milking only takes  $3\frac{1}{2}$  to 4 minutes for each cow.



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**Dip teats immediately after milking.**

### **Machine Stripping**

When the cow is nearly milked out, press down gently on the claw. This allows any milk that is trapped in the gland to flow out. Strip for only a few seconds. Excessive stripping can injure the teats and cause your cow to milk more slowly.

### **Milking Machine Removal**

Remove the milking unit gently. Never yank off the teat cups. Break the vacuum first by shutting off the vacuum valve, then by pushing down slightly on the top of one liner with your finger. When the vacuum is broken, the milking unit will fall into your free hand.

### **Teat Cups**

Sanitizing teat cups between milkings is optional when you are milking healthy cows. Normally, rinsing them in a bucket of clean water is sufficient.

Trapped air in the teat cups may prevent thorough washing or sanitizing. If you have a conventional claw-type bucket machine, open the milk valve before washing. If you

have a pipeline machine attached to the milk line, rinse two teat cups at a time. With suspended-type machines, simply tilt vertically.

### **Teat Dipping**

Immediately after milking, dip the teats in a disinfectant solution sold specifically for this purpose. Follow carefully all directions on the label. Allow the teats to "drip-dry".

Observe teats routinely to make sure they are not being chapped or irritated by the solution.

Teat dipping is recommended because a cow's teats can easily become infected with bacteria immediately after milking. Once colonies of bacteria are established on the teat ends, their invasion of the milk-producing tissues of the udder is very likely.

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**WARNING—EQUIPMENT  
SANITIZING COMPOUNDS CAN  
CREATE SERIOUS TEAT  
DAMAGE IF USED AS  
TEAT DIPS.**

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## **PSYCHOLOGICAL STRESS**

Psychological stress is a subtle and often overlooked contributor to mastitis. Stress causes the cow to release the hormone, adrenalin. Adrenalin interferes with the milk letdown hormone, and can cause the cow to hold up her milk. Prevent stress in your herd by—

- Enjoying your work.
- Establishing and maintaining a calm and pleasant cow-handling routine.
- Milking only as many cows as you can efficiently handle.

Prepared by  
Animal Science Research Division  
Agricultural Research Service